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"Looking After His Job"

"He was only looking after his own job as a moulder. The cheaper they could produce, the better their chances of keeping their markets and so safeguarding their own jobs." This was a remark made by Mr. H. Abnett, to the South African Branch of the Institute of British Foundrymen and used by him to stress the need for seriously reducing the quantity of stoved moulds in foundry practice throughout the Dominion. Mr. Leon Cachet's observation that "he had been in many [South African] foundries and it always struck him that the capacity of the foundry was the capacity of the drying stoves," crystallised the general opinion of the audience that green sand moulding needed intensive development within the Union. Though hinted at, it was perhaps insufficiently stressed that there was need for a Government survey of the moulding sand resources of South Africa, much on the lines carried out by Prof. Boswell for Great Britain and materially extended during this war. That is important, but what to our mind is outstanding is that Mr. Abnett should co-ordinate an industrial development with the future of his own job. It contrasts strangely with the optimism of a section of our own skilled men who apparently believe that every process innovation is a machination of the devil designed to put them out of work. It is recorded that when moulding machines were first introduced into this country, those whose duty it was to put them into operation received a hostile reception. Nowadays, the grouse is that the machine moulders have a lighter job and a heavier pay packet than the skilled floor moulder. In plain English, there is still too little recognition by this type of individual that the world's biggest buying organisations do exactly the same as the man in the street. Thus, if this type of individual hears that a shop can satisfactorily repair a main spring in his watch for 3s. 6d. when other shops charge 6s., that concern will get his order, but, unlike the big buyer, no inquiry will be made as to whether the owner pays trade union rate of wages or not. Before the war efforts were made by propaganda slogans to induce people to buy goods made by their own nationals. The slogan "Buy British" had its counterpart in many countries. Moreover, in some countries, especially Germany, intensive research was undertaken with the sole objective of rendering them economically self-sufficient. In Germany, unlike the "Buy British" movement, which was designed to help the British workman to keep his job or indeed to find one, the object was to prepare to counter the economic blockade—an obvious wartime measure. After the war every article of commerce needs some sort of mark guaranteeing that it has been made under conditions which conform to those laid down by the International Labour Office. Moreover, we would like every Government to prohibit the importation of machines and articles not carrying this assurance. This would result in competition being based on manufacturing efficiency carried out under hygienic conditions, and not upon the exploitation of labour, working under intolerable conditions. Such legislation would encourage those thousands of "Mr. Abnett's" working all over the world, to support by every means within their power industrial innovations, for, failing this, they would have to be satisfied that if jobs were lost to imports it was because of a better overseas "know-how" and not due to the exploitation of labour. For many years it has been our custom when visiting Continental foundries to enquire about regulations imposed as the equivalent of our Factory Acts. We received the impression that in general they were akin to our own, but in far too many cases they were not being carried out. This, too, requires international supervision.

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CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

THE I.B.F. EDUCATION REPORT

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I have just read in one of the national dailies under the title of "Who'll Do Dirty Jobs?" being part of a Report by the Institute of British Foundrymen, and for the first time the general public is given a slight introduction to one of the worries of the foundry owners, namely, the apprentice problem.

The Education Committee of the Institute says there are "economic causes" which the employees must investigate and remedy. I must confess ignorance of the "economic causes" but not the reasons, and there are many, why boys are reluctant to enter the foundry to learn and practice the complex craft of metal founding, or, when they have entered the foundry for that purpose, a number of them after a year or so secure work outside the craft.

One or two of these reasons are seen at a glance, such as the environment of the foundry in comparison with the rest of the engineering departments, but it takes years of experience of work on the foundry floor to learn some of the other reasons. For example, the older moulders, singly or in small groups, give the boy their reasons, inside and outside the shop, why they think it foolish for him to learn the trade. All the worst features of foundry life are continually impressed on him from the very first day he starts work, and on how many occasions this sort of "educational propaganda" succeeds can well be imagined. An unsympathetic foreman can be the cause of a promising boy leaving the trade by his failing to understand the boy's mind. More than once has the writer been a witness of this sort of thing when a kind word would have put things right.

There are more than three thousand iron foundries in this country, therefore the apprentice problem is a serious and important one, and, in the opinion of the writer, there is no other craft, followed by so large a number of men, which calls for a greater concentration of thought and intensive study, coupled with an expenditure of physical energy, than the craft of metal founding. Give a boy of ordinary intelligence something to make and let him develop to more intricate moulding and the foundry will hold him. Send him to work with Bill Jones as his boy labourer while his own tools go rusty in his tool box and he will soon begin to develop thoughts that have to do with things outside the foundry.—Yours, etc.,

W. GUDGEON.

67, Acregate Lane South, Preston.
January 1.

[The Report indicates the steps which should be taken to eliminate the propaganda described by our correspondent.—EDITOR.]

NEW METHOD OF INCOME-TAX DEDUCTION

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—With reference to the December 23 issue of your JOURNAL, may I point out a seemingly serious error at the end of the first paragraph of the article on page 322, "New Method of Income-tax Deductions Explained"? If you will refer to paragraph 10 of the pamphlet issued by the Financial Secretary of the Treasury dated September, 1943, with the title "A New System for the Taxation of the Weekly Wage Earners," you will find that the new system is to be brought into force as from April 6, 1944. I think that your April 15 must be a misprint.—Yours, etc.,

F. AYTON,
Works Director.

Ransomes, Sims & Jefferies, Limited,
Orwell Works, Ipswich.
December 29, 1943.

[We sincerely thank Mr. Ayton for drawing attention to this error—EDITOR.]

THE INSTITUTE OF AUSTRALIAN FOUNDRYMEN

The Institute of Australian Foundrymen (Victorian Branch) announce that the following Office Bearers have been appointed:—*President*, Mr. W. L. Allen; *vice-presidents*, Mr. G. Benson and Mr. S. G. Graham; *secretary*, Mr. T. R. P. Chapman; *hon. assistant secretary*, Mr. R. Cheers; *hon. treasurer*, Mr. G. D. Thompson; *members of council*, Mr. W. Main, Mr. A. M. Tennant, Mr. A. Abbott, Mr. W. Hanks, Mr. N. Hosking, Mr. W. Pola, Mr. R. Day, Mr. J. Morley, Mr. C. Smith, Mr. A. Crawford, Mr. J. Preston, and Mr. R. Mann.

Sub-Committees have been formed to cover publications, apprentice training, apprentice competition, social and publicity, finance, members' classification, sand sub-committee and constitution.

NOTES FROM THE BRANCHES

London.—The next meeting is being held at 2.30 p.m. on Saturday, January 22, at the Institution of Civil Engineers, Great George Street, London, S.W.1, when Mr. W. A. Baker, B.Sc., of the British Non-Ferrous Metals Research Association, is lecturing on the subject of the preparation of bronze test-pieces. Non-members are invited to participate. Particular note should be taken of what is a fresh meeting place for the Branch.

An Apology.—We regret in our issue of December 30, page 341, we omitted to state that Mr. E. R. Dunning's Paper on "The Syphon Brick Method of Cupola Tapping," was read before the Lancashire Branch of the Institute of British Foundrymen.

THE USE OF BASIC-LINED LADLES IN THE DESULPHURISATION OF CAST IRON BY SODIUM CARBONATE*

Report of Laboratory and Works Experiments with different lining materials

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(Abridged)

Introduction

The use of sodium carbonate for desulphurising cast iron has increased steadily over the past twelve years or so, until at the present time the quantity of metal treated probably exceeds two million tons per annum. The process is normally carried out without the use of any special materials for lining the ladles in which the reaction takes place. Ladles for containing molten iron are commonly lined with acid (siliceous) refractories, which may consist of sand, ganister or similar substance, rammed around a former or daubed on as a stiff paste to form a monolithic lining, or else of brickwork, usually firebrick containing 35 to 40 per cent. of alumina and the balance mainly silica, the joints between the bricks being a cement of composition similar to that of the bricks themselves.

It has long been known that the reaction whereby sulphur is removed from iron by sodium carbonate may be reversed in the presence of an excess of silica in the desulphurising slag according to the equation:

$$Na_2S + SiO_2 + MnO = Na_2SiO_3 + MnS.$$
$$(FeO) \qquad\qquad (FeS)$$

The use of sand for thickening the slag to facilitate its removal is undesirable therefore, and in its place limestone, either in the form of a powder or as dust-free chippings, is used.

Soda slag which has been used for desulphurisation usually contains upwards of 30 per cent. of SiO_2, this being derived from the ladle refractory, from furnace slag, which is often allowed to run into the ladle in spite of efforts to prevent it, and from silicon which is to some extent removed from the metal by the action of the soda slag. This degree of contamination of the slag does not matter in the case of most of the iron which is treated by sodium carbonate, and which contains before treatment 0.06 to 0.15 per cent. of sulphur. By the use of 1 per cent. of sodium carbonate about half this sulphur is removed, giving the metal a sufficiently low sulphur content for most industrial purposes. It is a more difficult problem, however, to effect an appreciable reduction in the sulphur content if the iron contains initially not more than 0.04 per cent. of sulphur and less than 1 per cent. of silicon. The effect of treating such an iron with even 1½ or 2 per cent. of sodium carbonate may be to reduce the sulphur by not more than 20 to 25 per cent. Irons containing relatively low percentages of manganese are also difficult to desulphurise.

During the past few years a demand has arisen for a greater degree of desulphurisation of cast iron than is possible by the application of sodium carbonate in ladles with siliceous linings. The following are some of the problems which have been encountered:

(1) In the manufacture of recarburising iron the raw material is the highest grade of hematite pig-iron. This usually contains not more than 0.025 per cent. of sulphur, and it is desired to reduce this to 0.010 per cent. or less.

(2) In the production of hematite pig-iron it is desirable to reduce the sulphur to the lowest possible limit, provided that the phosphorus content is also low.

(3) Owing to the wartime shortage of pig-iron and, pre-war, the abundance and cheapness of steel scrap, there is a strong inducement to use up to 95 per cent. of steel scrap in the cupola charges to produce metal for electric steel furnaces, for Tropenas steel castings and for refined pig-iron.

(4) In order to conserve certain alloying elements such as nickel, chromium and molybdenum, the "Rowden" process has been revived during wartime. This process involves the production, in a basic open-hearth furnace, of a synthetic pig-iron from alloy-steel scrap, and it is desired to desulphurise this in the ladle after tapping it from the furnace to bring the sulphur below 0.02 per cent.

(5) In the production of low-silicon basic iron for steel-making it is now becoming necessary to use iron ores containing more sulphur than was usual in the past. Owing to the better-grade ores having been used up, this difficulty is likely to be accentuated in the future. It is often necessary to remove more than 50 per cent. of the sulphur from the iron by a single sodium-carbonate treatment, particularly when the "acid burden" process is used.

One possible method of improving the efficiency of the sodium-carbonate process to solve the above problems is to substitute basic for acid materials in the refractory linings of the ladles used, so eliminating one source of silica in the desulphurising slag.

This is not an entirely novel suggestion, though the author is not aware that it has previously been extensively practised in Great Britain. In Luxemburg,[1] before the outbreak of war, ladles lined with tar/dolomite were used for the desulphurisation of basic

* A Paper prepared for presentation to the Iron and Steel Institute.

Basic-Lined Ladles

Bessemer iron with sodium carbonate, and it is reported that the lives of the linings ranged from 800 to 1,000 heats, as compared with 400 to 600 heats in the case of firebrick linings. When not in use, these linings were kept hot over a blast-furnace-gas burner. At a German works,[1] where sodium carbonate for desulphurisation was pre-melted, a rotary furnace lined with tar-bonded dolomite was used for this purpose. After treatment, the iron and soda slag were separated from one another by pouring them into a syphon ladle, this also being lined with tar-bonded dolomite. At another German works[2] experiments were made with pig-iron ladles lined with rammed dolomite, rammed magnesite, and rammed dolomite with 10 per cent. of graphite added. The blast-furnace runner was also lined with dolomite, though this is stated to have caused some trouble on account of cracking. The percentage of sodium carbonate used is not stated, but desulphurisation was increased from 32.7 per cent. in a fireclay lining to 48.2 per cent. in a basic lining.

The present Paper describes experiments which have been carried out during the past three years to find in greater detail how the use of basic linings affects the sodium-carbonate process.

Available Basic Ladle-lining Materials

Magnesite.—This is usually employed in the form of bricks, but monolithic linings can be made from the ground refractory bonded with magnesium chloride solution and 5 or 6 per cent. of light sodium carbonate. Magnesite was used in a few experiments in the present investigation, but in view of the fact that it is in short supply in wartime, its use was not considered very seriously; but it may be said that desulphurisation in magnesite linings is about equal to that in dolomite, other conditions being constant.

Calcined Dolomite (" *Basic* ").—Dolomite is found in various parts of Great Britain and supplies are reasonably plentiful. It consists of calcium-magnesium carbonate, and before it can be used as a refractory it must be burnt at a temperature of about 1,800 deg. C. to drive off all CO_2. Unfortunately, it is not stable in this condition, and if exposed to the atmosphere at normal temperatures, it hydrates (slakes) and disintegrates to a powder. Its use is, therefore, confined mainly to the linings of steel furnaces which are kept hot continuously. It is graded, and bonded by mixing it with about 6 per cent. of dehydrated tar.

Stabilised Dolomite.—" Basic " can be stabilised against hydration either temporarily or permanently. Temporarily this may be effected by mixing stearic acid (0.016 per cent.) with the Basic. This renders the material waterproof, so that it can be transported, and kept in stock for reasonable periods without deteriorating. Mixing with 4 per cent. of dehydrated tar gives a similar degree of protection. Such temporary methods are of some value for treating Basic which is to be used in, say, an open-hearth furnace and kept hot continuously.

Permanent stability is imparted to Basic by combining silica with it, to form tricalcium silicate and magnesia, leaving no free lime. The stabilised refractory contains 15 to 17 per cent. of silica and is prepared by grinding dolomite and serpentine with water, forming a slurry which is fed into a rotary kiln and fired at a temperature exceeding 1,600 deg. C.[2] It may be used in the form of clinker as it comes from the kiln, or it may be crushed and ground, and moulded into shape after mixing it with about 6 per cent. of water. The shapes may be used in the green state after drying, or may be refired before use. Other materials such as metallic oxides may be incorporated as fluxes, and bentonite may be added to give plasticity to the material when mixed with water.

Serpentine.—Serpentine is a mineral of which large deposits are available in Britain. It consists of magnesium orthosilicate.

Experimental Work

The experimental work which has been carried out is divided into two parts:—(1) Small-scale work in the laboratory; and (2) full-scale work in foundries and in iron and steel works.

Laboratory Work.—This was carried out in a Metropolitan-Vickers high-frequency induction furnace and was concerned with trying out the action of soda slags on various refractory materials and finding how the use of different refractories affects the degree of desulphurisation of certain types of cast iron.

Sillimanite crucibles are normally used in the induction furnace. Sillimanite is aluminium silicate ($Al_2O_3.SiO_2$ containing 63 per cent. by weight of Al_2O_3) and offers fairly good resistance to attack by sodium-carbonate slag. Ladle linings are usually made of either firebrick, loam or sand, all of which are attacked by sodium-carbonate slag to varying degrees. Sand and loam are more friable than any sort of fired brick or crucible, and therefore tend to contaminate the soda slag with silica to a greater extent until they have become cemented by slag.

Sillimanite crucibles are lined with other refractory materials in the following manner: The lining material is brought to the required condition by the addition of a binder and is then rammed into the crucible round a tapered wooden former, to give a lining ½ in. thick. The tool used for ramming has one end tapered for ramming the sides and to prevent layering of the material, and the other end flat for consolidating the bottom and finishing the top edge. A ½-in. thick lining reduces the capacity of a crucible from 11 to 12 lbs. to 6½ to 7 lbs. of cast iron.

The following bonding materials were used:—

(*a*) *Dehydrated tar*, used with Basic. It must be completely burned-off in a gas-fired furnace at about 750 to 850 deg. C. before the lined crucible is used in the induction furnace; otherwise it penetrates the

crucible walls and condenses in the zircon sand which surrounds the coil, upsetting the working of the furnace.

(*b*) *Magnesium chloride* (5 per cent. aqueous solution), used with magnesia linings. Alone it is not sufficient, the linings being too friable. A satisfactory lining was produced with the following mixture: Old ground magnesia brick, 658.3 grms; light MgO, 109.7 grms.; light Na_2CO_3, 38.4 grms.; magnesium chloride (as 5 per cent. solution), 20.0 grms.

(*c*) *Sodium silicate*, used as a bond for sand or stabilised dolomite. A grade of silicate solution having a SiO_2:Na_2O ratio of about 2:1 and a specific gravity of about 1.5 is suitable. It requires dilution with water before use.

(*d*) *Water*, used with sand and stabilised dolomite.

Rammed linings are porous and the first time they are used for desulphurisation with sodium carbonate the soda slag is usually almost completely absorbed in the lining and does not remain in contact with the melt sufficiently long. For this reason first melts do not always give representative results. This impregnation with slag strengthens the lining, however, and supports the view that sodium carbonate or ground soda slag might be mixed with certain refractories to act as a bond.

TABLE I.—*Common Grey Iron. Desulphurisation with Sodium Carbonate.*

Melt No.	Refractory.	Sodium Carbonate Used. %	Sulphur Content After Treatment. %	Percentage of Sulphur Removed.
*M*1200 *	Sillimanite	1	0·051	50·0
*M*1201	,,	2	0·039	61·8
*M*1175 *	Dolomite	1	0·039	61·8
*M*1191 *	,,	1	0·036	64·7
*M*1192	,,	1	0·036	64·7
*M*1194 *	,,	1	0·031	69·6
*M*1195	,,	1	0·034	66·6
*M*1196	,,	½	0·029	71·5
*M*1197	,,	2	0·031	69·6
*M*1218 *	Magnesia	1	0·093	8·8
*M*1219	,,	2	0·039	61·8

* This mark, in this and later Tables, indicates a first melt in a refractory. Owing to the porosity of rammed linings the soda slag is liable to be rapidly absorbed in the first melt and the desulphurisation of the metal may not be as efficient as in subsequent melts after the pores are sealed.

TABLE II.—*American Washed Iron and Carburised Mild Steel. Desulphurisation with Sodium Carbonate.*

Melt No.	Material.	Refractory.	Sodium Carbonate Used. %	Sulphur Content. % Before.	Sulphur Content. % After.	Percentage of Sulphur Removed.
*M*1176	American washed iron mixture.	Dolomite	2	0·034	0·025	26·5
*M*1198		,,	1	0·034	0·020	41·2
*M*1199 *		,,	2	0·037	0·021	43·2
*M*1202	Carburised mild steel (anthracite).	Sillimanite	2	0·098	0·036	63·4
*M*1213 *	Carburised mild steel (charcoal).	Dolomite	1	0·041	0·035	14·7

* First melt, *see* footnote to Table I.

Results of Desulphurising Experiments

Some preliminary trials were carried out on the desulphurisation of a common grey iron of the following composition:—T.C, 3.43; Si, 1.66; S, 0.102; P, 1.49; Mn, 0.67 per cent. On treating this iron with sodium carbonate, the results contained in Table I were obtained.

An attempt was also made to simulate the composition of the synthetic pig made in a basic steel furnace by melting and carburising alloy-steel scrap (the Rowden process). A mixture was made up containing the following:—American washed iron, 4 lbs. 3 ozs.; mild steel, 2 lbs. 1 oz.; ferro-silicon (70 per cent.), ¼ oz.; manganese, 1 oz.

Melts were also made of mild steel, and these were carburised with either anthracite or wood charcoal before the sodium-carbonate treatment was applied. The desulphurisation results are recorded in Table II. Following the preliminary trials, several series of melts were made with different irons, in both sand and tar/dolomite linings, with sodium-carbonate additions varying from ½ to 2½ per cent.

(1) *Common Grey Iron.*—The analysis of this material before remelting was:—T.C, 3.34; Si, 1.75; S, 0.152; P, 1.17; and Mn, 0.60 per cent. The results of desulphurisation tests will be found in Table III.

TABLE III.—*Common Grey Iron. Desulphurisation with Sodium Carbonate in Dolomite and in Sand Linings.*

Sodium Carbonate. %	Dolomite Lining. Melt No.	Dolomite Lining. Sulphur. After Treatment. %	Dolomite Lining. Sulphur. Percentage Removed.	Sand Lining. Melt No.	Sand Lining. Sulphur. After Treatment. %	Sand Lining. Sulphur. Percentage Removed.
½	*M*1239 *	0·075	50·6	*M*1231 *	0·114	25·0
¾	*M*1285	0·065	57·2			
1	*M*1240	0·079	48·0	*M*1232	0·098	35·5
1½	*M*1241 *	0·061	59·8	*M*1233	0·090	40·8
1½	*M*1284	0·038	75·0			
2	*M*1242	0·056	63·2	*M*1234	0·073	52·0
2½	*M*1243	0·067	55·9	*M*1235	0·062	59·2
2½	*M*1283	0·037	75·7			

* First melt, *see* footnote to Table I.

TABLE IV.—*Grey Hematite Iron. Desulphurisation with Sodium Carbonate in Dolomite and Sand Linings.*

Sodium Carbonate. %	Dolomite Lining. Melt No.	Dolomite Lining. Sulphur. After Treatment. %	Dolomite Lining. Sulphur. Percentage Removed.	Sand Lining. Melt No.	Sand Lining. Sulphur. After Treatment. %	Sand Lining. Sulphur. Percentage Removed.
½	*M*1263	0·024	31·5	*M*1268	0·033	5·8
1	*M*1262	0·0205	41·4	*M*1267	0·027	22·8
1½	*M*1261	0·0192	45·2	*M*1266	0·027	22·8
2	*M*1260	0·018	48·6	*M*1265	0·020	42·9
2	*M*1288 *	0·0175	50·0			
2½	*M*1259 *	0·0175	50·0	*M*1264 *	0·025	28·6
2½	*M*1289	0·014	60·0			

* First melt, *see* footnote to Table I.

Basic-Lined Ladles

(2) *Grey Hematite Iron.*—The analysis of this material before remelting was:—T.C, 4.41; Si, 1.49; S, 0.035; P, 0.023; and Mn, 0.76 per cent. The desulphurisation test results are collected in Table IV.

(3) *Miscellaneous Materials and Reagents.*—References have appeared in recent technical literature[4,5] to the desulphurisation of cast iron by mixtures of sodium carbonate and limestone added to the metal either in the molten condition or as sintered mixtures. Oelsen used the double carbonate, containing 48.5 per cent. of $CaCO_3$ and 51.5 per cent. of Na_2CO_3

TABLE V.—*Results of Desulphurisation with 2 Per Cent. of Sodium Carbonate in Four Different Refractory Linings.*

Lining Material :	Calcined Dolomite/Tar.		Stabilised Dolomite.	Serpentine.	Loam (Sand).
Grey Hematite Pig Iron.					
Sulphur, % : Before	0·019	0·019	0·019	0·019	0·019
After	0·008	0·012	0·013	0·020	0·021
Percentage of sulphur removed	58	36·8	31·5	Nil	Nil
Silicon, % : Before	2·57	2·57	2·57	2·57	2·57
After	1·96	1·95	1·98	2·11	2·30
Percentage of silicon removed	23·7	24·1	23	17·9	10·5
Grey Hematite Pig Iron.					
Sulphur, % : Before	0·019		0·019	0·019	0·019
After	0·008		0·012	0·015	0·018
Percentage of sulphur removed	58		36·8	21	5·3
Silicon, % : Before	2·57		2·57	2·57	2·57
After	2·11		2·04	2·26	2·30
Percentage of silicon removed	17·9		20·6	12	10·5
White Hematite Pig Iron.					
Sulphur, % : Before	...		0·029	0·029	0·029
After	...		0·009	0·014	0·024
Percentage of sulphur removed	...		69	51·8	17·2
Silicon, % : Before	...		0·14	0·14	0·14
After	...		0·06	0·06	0·10
Percentage of silicon removed	...		57	57	28·5
Common Grey Iron.					
Sulphur, % : Before	0·152		0·152	0·152	0·152
After	0·032		0·059	0·083	0·078
Percentage of sulphur removed	79		61	45·4	48·6
Silicon, % : Before	1·75		1·75	1·75	1·75
After	1·14		1·10	1·15	1·21
Percentage of silicon removed	34·8		37·1	34·2	30·8

by weight, and having a melting point of 813 deg. C. It was thought that it might be opportune to try similar mixtures in acid and basic linings. The results are interesting, though the series of tests was discontinued when it was seen that the mixtures have no definite advantage over sodium carbonate used alone.

It was suggested to the author that cast iron might be dephosphorised by treatment with mill scale mixed with the desulphurising reagent. This and other suggested methods of dephosphorising cast iron were tried, without success. Attempts were made to desulphurise steel, and these showed slight promise.

A further suggestion made to the author during the course of the investigation was that serpentine (magnesium orthosilicate) might function as a basic refractory. It was tried, but the results were disappointing, and the crucible linings were severely attacked on the slag-line.

The desulphurisation of iron in stabilised dolomite was studied in a large number of melts, as this refractory has advantages over basic for lining ladles which are allowed to cool down and remain for long periods in atmospheres sufficiently humid to cause the disintegration of the Basic. As would be expected from the presence of 15 per cent. of silica in stabilised dolomite, the results, so far as desulphurisation is concerned, were not as good as those obtained in tar/dolomite linings. They were better, however, than results in siliceous linings, and the practical advantages of the stabilised product should not be loss sight of, such as, for example, the ease with which it can be stocked, or supplied to foundries in small quantities.

Final Series of Laboratory Tests

After the experience gained in the experiments already described, a series of melts was planned under conditions as nearly constant as possible, to compare the action of sodium carbonate on various types of cast iron in the four available refractory linings. The refractories used were: (1) Calcined dolomite, tar-bonded; (2) stabilised dolomite, water-bonded; (3) serpentine, water-bonded, and (4) loam, water-bonded. In each lining, four melts were made in the following order, treating each melt with approximately 2 per cent. of granular sodium carbonate:—Melt 1—grey hematite pig-iron; melt 2—grey hematite pig-iron; 3—white hematite pig-iron, and 4—common grey iron.

The reason for making two melts of grey hematite iron was that, as previously explained, in the first melt in a rammed lining the soda slag is almost entirely absorbed by the lining unless the dosage of sodium carbonate is fairly high. The first melt in the series now to be described was, therefore, primarily to seal the pores of the refractory. The analysis of the grey hematite iron as received was:—T.C, 3.86; Si, 2.57; S, 0.019; P, 0.035, and Mn, 0.87 per cent.

The analysis of the white hematite iron as received was:—T.C, 3.12; S, 0.14; S, 0.029; P, 0.032, and Mn. 0.18 per cent. The analysis of the common grey iron has been detailed earlier.

The results of this series of tests are given in Table V. They show that: (1) In the various refractory materials tested, the efficiency of desulphurisation with sodium carbonate is in the following order:—(1) Calcined-dolomite/tar; (2) stabilised dolomite; (3) serpentine, and (4) loam (sand). (2) Sodium carbonate gives a worth-while degree of desulphurisation in both calcined-dolomite/tar and stabilised dolomite, even when the initial sulphur content of the iron is low (0.03 per cent. or less). With such irons, very little desulphurisation takes place in serpentine or sand linings. (3) An appreciable degree of desulphurisation takes place in all the types of lining tested when the initial sulphur content of the iron is of the order of 0.1 to 0.2 per cent.

Note.—The results set out in Table V are comparative among themselves, but should not be regarded as indicative of the actual desulphurisation to be expected under full-scale working conditions. In the induction-furnace experiments the reagent is put on top of the melt, whereas in full-scale working the reagent is put in the bottom of the ladle and the metal is tapped on to it. It should also be pointed out that it is not easy to maintain constant temperature conditions in a small induction furnace, and this may account for some of the slight discrepancies in the work. In full-scale working it should be possible to maintain a much more constant temperature from melt to melt.

Desiliconisation of Cast Iron

Treatment by sodium carbonate invariably removes silicon from cast iron, and with an acid ladle lining material it is usual for the silicon content to be reduced by about 0.1 to 0.2 per cent., *e.g.*, from 2.0 to 1.85 per cent., under full-scale working conditions.

The analysis of sodium-carbonate slags usually shows the presence of 25 to 35 per cent. of silica. It would be expected that most of this would come from the ladle lining, and that it would be lower when a basic lining was used. This is, in fact, the case, but the silica content of the slags remains surprisingly high, in the region of 20 to 25 per cent. The results given in Table V show that the loss of silicon from the melt is higher in a basic than in a siliceous lining. This is confirmed by some of the preliminary experiments, the silicon losses being set out in Table VI.

The differences are, in most cases, not sufficiently pronounced to indicate more than a tendency for the metal in basic linings to lose more silicon, but the tendency is in the direction which would be expected and may be of importance in the treatment of basic iron.

Visible Attack on the Refractories.—After the series of experiments set out in Table V, the dolomite/tar and stabilised-dolomite linings showed practically no signs of attack by the soda slags. The surface was glazed, but the soda slag did not appear to have penetrated to any considerable depth. Both the serpentine and the loam linings were severely attacked and were cut by very deep slag-lines.

Methods of Preparing Basic Linings for Ladles

Ladle linings may be prepared by ramming the ground refractory, mixed with a suitable binder, round a wooden or metal former to produce a monolithic lining, or they may be constructed of refractory bricks. Basic, on account of its strong tendency to hydrate, must be bonded with tar and not with water.

The Basic is prepared by grinding to produce a mixture of particle sizes with a high packing density, and is mixed in a light pan-mill with dehydrated tar preheated to 80 deg. C. About 6 per cent. of tar by weight is usually used. The tar/dolomite mixture is reheated to about 70 deg. C., and is rammed with pneumatic rammers. The former for shaping the lining is best made of wood covered with sheet steel and oiled before use. In preparing the ladle bottom, particularly in the case of large ladles into which molten iron is to be poured from a considerable height, it is desirable to have one or more layers of brick underneath the dolomite. Ordinary firebrick may be used, and it also acts as a heat insulator. It is usual for the tar to be burned-out before the ladle is used, but this is not always done.

In lining small ladles (up to 2 tons) it is not necessary to have any brick backing for the sides. The tar/dolomite mixture can be rammed directly on to the shell of the ladle. It has been found that, once a dolomite lining has received a coating of slag, it does not disintegrate rapidly, and it is possible, for example, to let it get cold for repairs at the week-end without any visible disintegration taking place.

When stabilised dolomite clinker or parging cement is used the technique is similar, but the refractory can be bonded with 6¼ per cent. of water in place of dehydrated tar, as it has cementing properties. The following method was used in lining 2-ton ladles at the works of K. & L. Steel-founders & Engineers, Limited, of Letchworth. The bottom of the ladle was

TABLE VI.—*Desiliconisation by Sodium Carbonate in Dolomite and Sand Linings.*

	Desiliconisation, %.			
Sodium Carbonate Used (Approx.):	½%.	1%.	1½%.	2%.
Common Grey Iron (1·6% *Silicon*).				
In dolomite lining	0·22	0·32	0·35	0·40
In sand lining	0·07	0·19	0·32	0·28
White Hematite Pig Iron (0·57% *Silicon*).				
In dolomite lining	0·05	0·10	0·16	0·23
In sand lining	0·07	0·11	0·08	0·14
Grey Hematite Pig Iron (1·4% *Silicon*).				
In dolomite lining	0·11	0·16	0·24	0·29
In sand lining	0·10	0·21	0·20	0·29

first levelled with 2 to 3 in. of refractory mixed with the requisite quantity of water. This layer was rammed hard and was then covered with a 3-in. layer of stabilised-dolomite bricks jointed with some of the ground mixture. Another 3-in. layer of the latter was rammed on top of the bricks to complete the bottom. The cast-iron former was then placed in position and the sides of the ladle were rammed. The lining was then air-dried for 24 hrs., followed by 24 hrs. with a wood fire in the ladle, then 24 hrs. with a coke fire; finally, it was heated over-night inverted over a coke fire with forced draft.

A small quantity of sodium silicate may be dissolved in the water used for mixing stabilised dolomite to increase the strength of the bond. It is not desirable to use more silicate than is absolutely necessary, as it will reduce the refractoriness of the mixture. A suitable grade of sodium silicate for the purpose is a solution having a SiO_2:NaO_2 ratio of approximately 2:1 and a specific gravity of approximately 1.5; 2 per cent. of this diluted with about twice its volume of water and mixed with the refractory gives satisfactory results.

Basic-Lined Ladles

Full-Scale Experiments

Several full-scale experiments have been carried out, or are still in progress, by firms using the sodium-carbonate process for desulphurising molten iron. Much useful information has been accumulated, demonstrating the advantage of basic-lined ladles for this process due to the absence of chemical attack on the lining by soda slags and the improved degree of desulphurisation.

Stabilised Dolomite, Tar-Bonded.—In the early stages of the investigation two ladles were lined with tar/stabilised-dolomite. In both cases the results were inconclusive, but appeared on the whole to be better than those of parallel tests in acid linings. The linings themselves gave a certain amount of trouble. The grading of the dolomite clinker was too coarse, and it was not possible to get the upper part of the linings properly consolidated, nor were the linings fired at a sufficiently high temperature to produce a good bond.

Stabilised Dolomite, Water-Bonded.—Stabilised dolomite can be bonded with water or tar, and experiments with the former were carried out at Letchworth. The details of the method used for lining the ladle were as recorded above.

The ganister-lined ladles normally used are always severely attacked near the bottom by soda slag. The reason for this is that the ladles, which are used for the desulphurisation of cupola iron and its transfer to Tropenas converters, always carry an excess of metal. Consequently, after the converter has been filled a shallow pool of molten iron remains in the ladle, and in the dose of sodium carbonate for the next charge of metal is put in in readiness. The sodium carbonate melts and attacks the ladle lining at a level of 1-4 in. from the bottom, forming a deep undercut. If, as occasionally happens, the residual metal solidifies, it cannot be removed without further serious damage to the lining. Patching is necessary after only a short period of use.

The first ladle lined with stabilised dolomite behaved much better. There was no apparent wear for three days and no patching was needed until after the fourth day. No undercutting took place, but the lining became barrel-shaped, which would appear to be due to attrition by the metal and not to attack by soda slag. This lining resulted in better desulphurisation than is obtained with ganister linings. The average sulphur content of the metal after treatment was 0.037 per cent., as compared with 0.043 per cent. in ganister linings.

After four days' use, the lining was patched with a specially prepared stabilised-dolomite cement mixed with 11½ per cent. of water. This patching material began to come away from the lining after three or four heats of metal had been through it. In the author's opinion, this unsatisfactory behaviour of the patching material was due to the failure to chip away the glaze from the lining before patching it. Undercutting of the old lining by means of a suitable tool would also assist the adhesion of the patches.

Unfired Stabilised-Dolomite Bricks.—One of the disadvantages of some types of basic bricks is their tendency to spall much more readily than siliceous refractories do. Therefore, when it was decided to try a stabilised-dolomite-brick-lined ladle at Letchworth, the suggestion was made to try unfired bricks, as it was thought that their resistance to spalling might be better than that of the ordinary fired bricks. A subsequent spalling test showed failure after four reversals (heating and cooling), as compared with two reversals in the case of the fired bricks. The unfired bricks were fragile, and a number were broken in transit, but since these experiments were carried out the makers have succeeded in improving the bond considerably.

The ladle lining consisted of a 4½-in. thickness of brick, with a backing of 2 in. of parging cement. It behaved well for 100 heats of metal, all treated with sodium carbonate. After this period it appeared to justify further patching. The degree of desulphurisation was similar to that in a rammed stabilised-dolomite lining.

Stabilised-Dolomite Bricks.—Steelfounders & Engineers, Limited, have experimented with a ladle lined with stabilised-dolomite bricks. Unfortunately, on account of war conditions, it was not possible to make these bricks in special shapes, only "squares" and "splits" being available. This resulted in some of the joints being thicker than is desirable, but in spite of this the lining behaved extremely well. The jointing material was a cement with a stabilised-dolomite base, and this resisted sodium-carbonate slag satisfactorily. Patching was carried out when necessary with the same material, and daily renewal was needed once it had been started. (A special patching material—also with a stabilised-dolomite base—is now available, and should be used in preference). It is probable that it would have lasted longer had it been keyed-in by first undercutting the original lining and removing the surface glaze. Spalling gave practically no trouble at all. On the first day that the lining was in use, it appeared to be spalling a little, but this did not continue once the bricks had become impregnated with soda slag. The average sulphur content of the finished steel was 0.032 per cent., as compared with 0.043 per cent. when a ganister-lined ladle is used.

Semi-stabilised Dolomite Bricks.—Semi-stabilised dolomite bricks are produced for use in positions not exposed to hydration. They are given a temporary stability sufficient to protect them for about a month before they go into service. The author has not had an opportunity of testing such bricks in a ladle lining, but some of them have been kept in contact with molten sodium carbonate at a maximum temperature of 1,020 deg. C. for some days. They resisted chemical attack very well, and only slight signs of cracking were observed, whereas the fully stabilised bricks cracked much more.

(*Continued on page* 39.)

FUEL ECONOMY IN THE IRON FOUNDRY*

By COLIN GRESTY (Chief Metallurgist to the North-Eastern Marine Engineering Company (1938), Limited, Wallsend)

(Slightly Abridged)

Planning is proved to be of major importance in saving fuel

Fuel economy in iron foundries, like all economy campaigns, is not a popular subject for two particular reasons. In the first place, foundrymen are very conservative and are loath to change well established practice which may have taken years to build up. They realise that foundry work is very sensitive to changes which, although apparently of a minor character, frequently have far reaching effects. Secondly, economy in fuel is not a matter of major importance from the financial point of view because, except in the case of low price castings, the cost of fuel is only a very small item in the total cost of a casting. Thus, in a foundry producing castings costing, say, 40s. per cwt., the cost of fuel is probably in the neighbourhood of 2s. per cwt., i.e., 5 per cent. of the total cost. A saving of 10 per cent. in fuel, therefore, represents only ½ per cent. of the total cost, and constitutes no inducement for the foundryman to run any risk on important work.

There are, however, directions in which, by organising certain work with a fuel economy bias, considerable progress may be made without necessitating any vital change in practice.

Cupola Practice

So far as cupola practice is concerned, every founder should ask himself the question, "Am I melting more metal than is essential to produce my output of castings?," and should not answer it until he has investigated the various factors which bear upon it. The relationship between the nett output of castings and metal melted can be conveniently expressed as "percentage yield," or merely "yield," meaning the nett output of castings for each 100 tons of metal melted. An increase in yield has obviously a direct effect on the consumption of coke as less metal has to be melted for a given output. It has been personal experience that many founders do not know their yield figure and do not appreciate its importance, largely because all excess metal is returned to stock as scrap, apart from the very small amount actually lost in melting.

There are, of course, several factors which influence the yield, the chief of which is the class of work carried out. Thus it is found that yield figures in different branches of the industry show very wide variations—actually from about 35 per cent. in the case of certain types of light castings, in which the proportion of runners, sprues and risers is high, up to more than 80 per cent. in foundries doing heavy, plain work. While this is the major factor there are others common to all foundries, for example, the amount of excess metal which has to be pigged or put on the floor due to the metal not being hot enough for pouring into castings, to over-estimation of the amount required, and to delays caused by moulds not being ready at the correct time. In fact, a good yield figure reflects the care which has been taken in planning a good many small items.

Nine Hundred Tons Saved

Fig. 1 shows graphically the relationship between yield and the consumption of charge coke (i.e., excluding the coke in the bed) per ton of castings, it

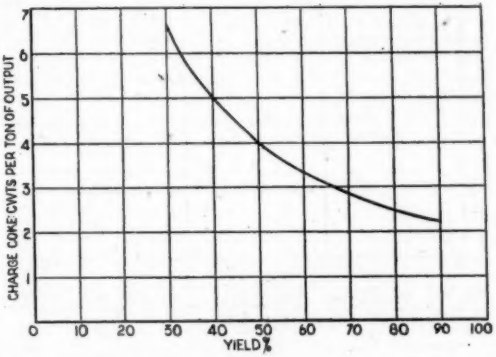

FIG. 1.—RELATIONSHIP BETWEEN YIELD AND CONSUMPTION OF CHARGE COKE.

being assumed that 2 cwts. of coke are required for each ton of metal melted. In the majority of foundries on Tyneside doing marine and similar work it is probable that the yield is in the neighbourhood of 60 per cent. Taking the latter figure as a basis, Fig. 2 shows the percentage saving in charge coke which would be achieved if the yield were increased.

The next item of importance is the economy which can be obtained by reducing the number of melts. A cupola requires the same amount of bed coke each time it is put on, irrespective of how much metal is going to be melted. It follows, therefore, that a direct saving is achieved by having a small number of long runs instead of a large number of small runs. Curve A in Fig. 3 illustrates this point by showing

* A Paper presented to a Regional Fuel Conference at Newcastle.

Fuel Economy in the Iron Foundry

the coke consumption (bed coke plus charge coke) per ton of metal melted in the case of a foundry requiring 60 tons of molten metal per week, according to the number of days on which metal is melted, while Curve B shows the percentage saving of coke effected. It will be seen that by melting on five days each week instead of six the saving is 5½ per cent.—quite an appreciable amount—and if the number of days can be restricted to four or three per week the saving is progressively higher. It is appreciated, of course, that in a busy foundry under wartime conditions the extent to which this can be applied is probably controlled by the available floor space.

The two factors of yield and number of runs are obviously associated because if the yield is increased then the metal required for a given output is reduced, thus making it easier to have fewer runs. In Table I. examples combining these two factors have been worked out from which it will be seen that by allowing for reasonable increases in yield and reduction in the number of runs, considerable economy in coke is obtained. It has been assumed that an output of 40 tons of castings per week is required, that the present amount melted is 70 tons per week, and that a 5-ton per hr. cupola is employed which requires 10 cwts. of coke for bed and 2 cwts. of charge coke per ton of metal charged.

As an example taken from actual practice of what can be done, the average 6-monthly yield for one foundry since the outbreak of war has been increased from 54 to 64 per cent. If the yield had remained at the lower figure the whole time, the amount of coke consumed would have been approximately 900 tons more than it actually was. In a second foundry the yield has been increased from 50 to 63 per cent. during the same period.

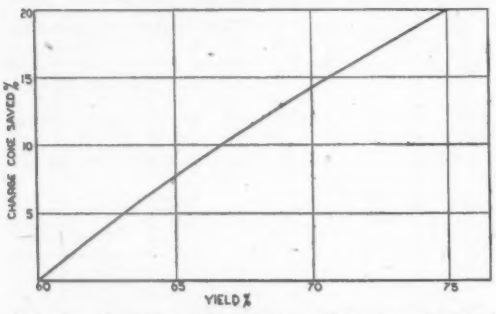

FIG. 2.—POTENTIAL PERCENTAGE SAVING THROUGH BETTER YIELD.

Cupola Design

The next point to be dealt with is the influence of cupola design on fuel economy, and this resolves itself mainly into a consideration of means by which the amount of coke required in the bed may be reduced. From this point of view the ideal design is that of a cupola fitted with a receiver and having a single row of tuyeres placed very low down. The lining should be parallel from the charging door down

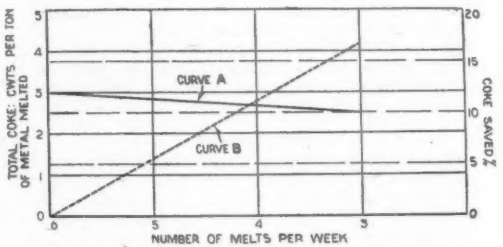

FIG. 3.—SHOWS EFFECT OF LARGE RUNS ON COKE CONSUMPTION.

TABLE I.—*Showing the Influence of Fewer Runs on Fuel Economy.*

Weekly output.	Metal Melted.	Yield.	No. of runs.	Average melted per run.	Coke used.			Coke saved.	
					Bed.	Charge.	Total.	Amount.	Per cent.
Tons.	Tons.	Per cent.		Tons.	Cwts.	Cwts.	Cwts.	Cwts.	
40	70	57.1	6	11½	60	140	200	—	—
40	70	57.1	5	14	50	140	190	10	5
40	70	57.1	4	17½	40	140	180	20	10
40	65	61.5	6	10¾	60	130	190	10	5
40	65	61.5	5	13	50	130	180	20	10
40	65	61.5	4	16¼	40	130	170	30	15
40	60	66.66	6	10	60	120	180	20	10
40	60	66.66	5	12	50	120	170	30	15
40	60	66.66	4	15	40	120	160	40	20
40	60	66.66	3	20	30	120	150	50	25

to about 2 ft. 6 in. above the tuyeres, and should then be tapered to a diameter, at about a foot above the tuyeres, of some 9 to 12 in. less than the main diameter. A furnace of this design is very economical in bed coke and, if supplied with air from a variable speed fan or blower, is also ideal for working under metallurgical control.

At present, however, the author is chiefly concerned with the question of what can be done to modify existing furnaces to bring them as far as possible into line with the foregoing. If a cupola has two rows of tuyeres, it is a simple matter to blank off the top one and to increase the size of the tuyeres in the bottom row so that the total area remains the same. Also, a reduction in the diameter of the lining can easily be made but, unless the cupola has a receiver, it is necessary to take into account the fact that a reduced diameter means that the metal holding capacity of the well will be correspondingly reduced. The addition of a receiver is a much bigger problem, and may not be practicable in many cases, on account of the low level at which it must be set in relation to the cupola.

Core- and Mould-Drying Stoves

As in the case of cupola working, the author would refer foundrymen to the Report of the Institute of British Foundrymen for a great deal of valuable detailed information as to the direction in which fuel economy may be achieved in core- and mould-drying stoves. Under present circumstances there can obviously be no wholesale installation of new plant, and it remains to make the best use of what is available. The greatest difficulty in dealing with the matter is that in all but mass-production foundries there is no yard-stick by which efficiency can be measured because so many and varied factors are involved. There are, however, certain steps which can be taken to ensure that the most economical use of fuel is attained.

(1) As few stoves as possible should be employed by filling those in use to capacity. This may involve extra lifting of moulds and cores, and be at times difficult to arrange, but it is unquestionably one of the most important factors in the saving of fuel.

(2) Each stove should be fitted with a recording pyrometer so that drying may be done on a definite temperature/time basis. For the guidance of the fireman a heavy line should be marked on the chart at the desired temperature and his interest obtained in seeing how closely he can work to it. Although at first he may not like having a tell-tale instrument fitted, he will soon realise that it shows when he has done his job just as surely as when he has not.

(3) The fuel consumption of each unit should be ascertained and checked periodically. This, in itself, leads to a greater interest being taken in the matter by all concerned, including the operatives. Also, it will probably show that some stoves are more efficient than others, thus leading to investigations as to the reasons for such differences.

(4) The heating unit should be maintained in an efficient manner and all flues in the stove kept clean.

There are no adequate means by which the fuel efficiency of stoves such as are employed in jobbing foundries can be reliably assessed. Nevertheless, the author has endeavoured, by reviewing the records of a good many stoves in two foundries, to arrive at approximate figures for fuel consumption per 1,000 cubic feet of stove space per overnight drying period. The records cover various types of stoves, including the "Heat Accumulator" type, which requires only coke breeze and partly burned coke, a battery of three large stoves fired from a common firebox unit, several stoves of the type having small individual fireboxes and also some old fashioned ones having open fires using natural draft.

The results of this review are given with all reserve in Table II chiefly in the hope that they will encourage founders generally to take systematic records of the performances of their stoves. Experience has shown that, even if such records are not of much value for comparison with other foundries, they are a valuable first step in the improvement of one's own practice. They lead to a desire for temperature records also, so that fuel consumption, temperature and time can be linked together and, ultimately, to the establishment of a temperature-time system of working.

TABLE II.—*Relative Fuel Consumption in Various Types of Drying Stoves.*

Type of Stove.	Cwts. of coke per 1,000 cub. ft. of drying space per overnight drying period.
(1) "Heat Accumulator," forced draft.	2½/3. Mixture of breeze and partly burned coke.
(2) Battery of stoves with common firebox.	1¾/2. Coke nuts.
(3) Stove with individual firebox, forced draft.	2/2½ „ „
(4) "Open" fire, natural draft.	2½/3½ „ „

Of the stoves covered by Table II the "Heat Accumulator" type is the most efficient from the point of view of fuel economy as it requires only coke breeze and partly burned coke from the cupola dump or from other sources. Its drawback is that it takes much more labour to keep it in a clean and efficient state than do the other types; also the cost of maintenance is fairly high. Therefore, in practice, the financial advantage of using low grade fuel is to some extent offset by the factors mentioned.

Regarding the battery type, experience has shown that it is economical in fuel and in cost of maintenance. Although arranged for operating the stoves either singly or two or three together there is a decided drop in fuel economy if they are not all in use. Thus if two stoves only are employed the fuel required

(*Continued on page* 34.)

BOSSES ON PEGS

By "CHECKER."

When deep bosses are required in coreboxes, and their position makes it necessary for them to be loose for drawing purposes, they may be more accurately positioned on pegs situated in the side of the corebox than by any other method; this gives a good bearing through the sides and the possibility of the bosses being rammed out of place is inconsiderable.

Fig. 1 shows a boss through the side of the corebox, and all the shapes are diameters, so the peg can be turned in the lathe. The shaped end on the outside has the dual purpose of acting as a stop for position, and gives a grip to facilitate withdrawing. These pegs have to be removed from the core before it leaves the corebox, and a good clean draw is assured.

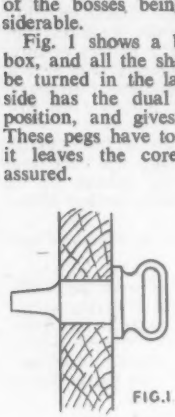

FIG. 1

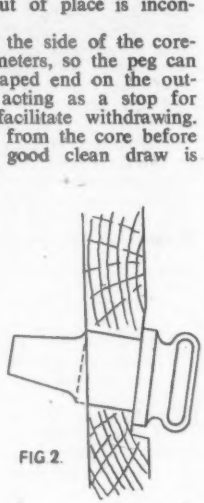

FIG. 2.

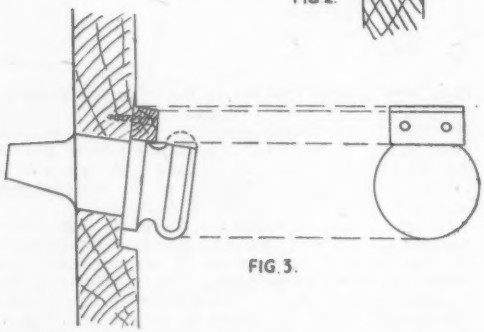

FIG. 3.

If the boss is not at right angles to the side of the box, as shown in Fig. 2, the peg should be turned in the lathe. The dotted line shows the allowance required for the fillet to be worked to follow the shape inside the corebox after it has been positioned through the side. With the fillet matching the side of the corebox as shown, these pegs can only be correct when in that position; therefore, some arrangement has to be made whereby the peg can only be placed

(*Concluded in next column.*)

FUEL ECONOMY IN THE IRON FOUNDRY

(*Continued from page* 33.)

only drops to about 80 per cent. of that required when the three are all in use. The third type, while somewhat lower in fuel efficiency, is very simple to operate and to maintain in good order. Type No. 4 is also simple to operate, requiring very little attention and maintenance costs are very low. The fuel consumption is rather high, however, and much more variable than the others.

Drying Moulds in Situ

In general, for the drying of large moulds which cannot be stoved, the use of portable driers with forced draft is much more economical than drying by braziers or "floor" fires, the latter in particular being very wasteful. Forced draft ensures that the heat reaches the deeper and more inaccessible parts of a mould much more readily than it does with braziers.

There is one qualification, however, which should be made to this general statement as there are certain moulds which, from practical experience, can be dried with less coke by using braziers than by portable driers. This is in cases of fairly plain jobs of which the number to be made justifies the cost of making special braziers to fit the moulds more closely than usual. To quote an example, marine engine columns can be dried very economically by hanging several small firebaskets of rectangular shape from one end of the mould to the other. By this means the flat surfaces of the mould are all close to the fire with the result that they are dried very evenly with remarkably little coke.

Reclamation of Partly Burned Fuel

In conclusion, special attention is drawn to one source of waste which frequently occurs in foundries, viz., the consignment of partly burned fuel to the rubbish heap. In normal times this may not be worth the cost of reclamation but, under present circumstances, it should be recovered and used in the drying stoves. In this same connection it is of great advantage to have one stove at least which is capable of using the breeze which inevitably arises from the handling and storage of coke.

(*Concluded from previous column.*)

in the corebox in the correct position. Different methods can be used to achieve this end, one of the best being to cut away the side of the corebox on the outside to suit the angle of the boss, making it large enough to give a good surface for the shoulder of the boss; this is shown in Fig. 2. To ensure the boss will not move out of position, a flat should be cut on the top and a piece of wood to match this flat should be screwed on the side of the corebox, as shown in Fig. 3; this will guarantee accurate positioning of the boss every time.

NOTES ON OIL-SAND PRACTICE IN THE ORDINARY FOUNDRY

Useful hints are given on the drying, storage and handling of cores

By WM. Y. BUCHANAN

(*Continued from page* 12.)

It is interesting to refer in passing to an example of a grinding mill, shown in Fig. 11, found in the excavated ruins of Italy, where presumably it represented a design developed in the early days of the First Roman Empire. This has a bowl-shaped pan with marble rollers which followed the same curve as the bowl. The underlying idea in a mill of this type would be to produce the maximum rubbing on all parts of the working surfaces, where it will be observed that the most work would be accomplished on the parts furthest from the centre, *i.e.*, rim-running rather than bottom running.

All the foregoing tends to show a natural tendency to rim-running mixing machines, and it is suggested here that there are some signs of support for this

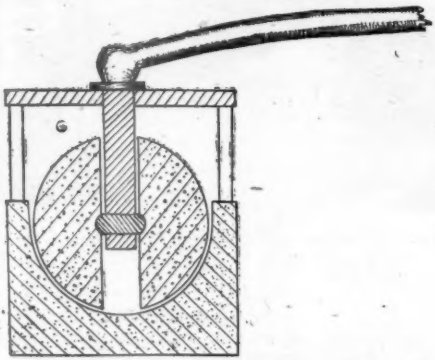

FIG. 11.—SKETCH SHOWING THE FORM OF AN EARLY ROMAN GRINDING MILL. ACKNOWLEDGEMENT IS DUE TO MR. E. J. R. MITCHELL FOR THIS SKETCH.

theory. The improved performance of the particular oil-sand mixer described, the new type Fordath machine, may be attributed largely to development on this principle. To quote another case: in recent American practice a new type of mill (Fig. 12) has been put on the market, which is entirely edge running. This consists of a mill in which the rollers fly out horizontally on the vertical sides where all the milling and mixing goes. The first design of this mixer used spherical rollers which are free from contact with the sides when at rest so that the effort required to start the machine was small and the sand is thrown outwards to the path of the rollers as the speed of rotation increased.

Since then the design has changed slightly, in that the spherical rubber rollers have been replaced by flat disc wheels with narrow rubber tyres. The sides of the machine have also changed from spherical to flat cylindrical shape. The paddles or scrapers are also simplified. The wearing surfaces on which the mulling takes place are evidently covered with rubber which increases life and do not encourage adherence of the clay-bonded sand. A new feature is the air-cooling of the pan, which allows direct use of knock-out sand and at the same time removes fines. This is evidently becoming popular in America. In the mixing of oil sand the power used is high and the temperature often rises sufficiently to encourage "drying out," especially if the mixing is too long. The air-cooling system should operate beneficially in this connection.

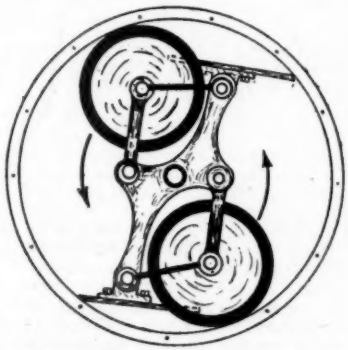

FIG. 12.—DIAGRAMMATIC ILLUSTRATION OF RIM RUNNING MILL NOW IN OPERATION IN AMERICAN FOUNDRIES.

Drying

The drying or baking of oil sand is dependent on certain definite chemical and physical changes, and the process can profitably be studied on a laboratory scale from several different points of view. Without going into the subject of sand control, a brief reference may usefully be made here to a few points of particular reference to oil sand. Assuming the test-piece to be produced by the standard A.F.A. method,

Oil-Sand Practice

the type of drying oven should be suitable for the purpose. It should conform to the required standards of the A.F.A. at least, and should be so constructed as to convey the heat to the test-pieces by a continuous current of hot gas (not recirculated) and have no direct radiation from heater elements inside the heating chamber. The conditions should be so standardised that all tests will be heated exactly alike and quite free from disturbing secondary factors.

The oven should be capable of adjustment to give any desired temperature inside a wide range so that the effect of temperature on the properties of baked sand can be studied. This is most important, as oil sand is rather sensitive to temperature and the properties are apt to change rapidly with slight differ-

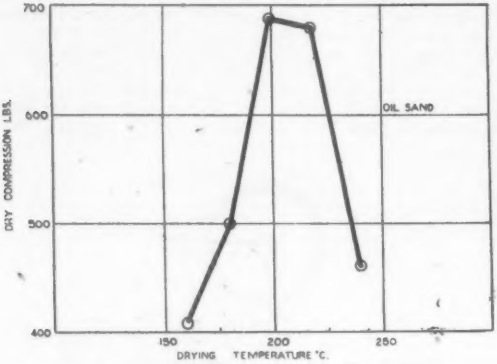

FIG. 13.—GRAPH SHOWING THE VERY CRITICAL EFFECT OF DRYING TEMPERATURE ON THE STRENGTH OF OIL SAND.

ences of temperature of baking, as shown in the example in Fig. 13, in which 200 deg. C. appears to be the most suitable for the standard test and time of baking. Under 200 deg. C. the test-piece is not properly baked and over 200 deg. C. it is over-baked or burnt, as shown in the compression strength of test-pieces dried at different temperatures. This curve and the inferences to be drawn from it differs with different types of organic binder and also where the addition of clay-bonded sand is higher.

The information provided gives a basis for regulating the drying of cores in the foundry on production scale, although it should be remembered that a pyrometer fixed on the wall of a large heating chamber, such as a foundry stove, does not give any indication of the maximum or minimum temperatures in all parts of the stove, and these may vary considerably when the hot gases enter at one end and leave at the other. It may be worth while to chart out the temperature variations in a stove by pyrometer readings through the wall at numerous points or indirectly with compression strength tests on test-pieces placed in any desired arrangement throughout the stove.

In any case, the chemical and physical mechanism of the baking in any particular stove should be clearly understood, and the performance of the stove maintained at a high level by periodic examination of the flue draft, furnace fittings and refractories, quality of fuel, etc.

FIG. 14.—PHOTOGRAPH SHOWING CORE CARRIAGE BUILT UP WITH MOVEABLE RACKS OF SUITABLE SECTIONS.

Core Racks

The method of stacking the cores on a carriage will, of course, determine the output of a stove and also the economy of the drying process. Fig. 14 shows a method used by the author. Since this has now operated for some nine years or so it has therefore stood the test of time and the usual hard usage of foundry conditions.

The frames consist of cast-iron ends made to fit one on top of the other, and these are secured rigidly by means of 1⅛ in. dia. bolts. As shown in Fig. 15, the single racks give a maximum clearance for cores of 12 in., while the double racks give a clearance for cores of 18 in. By this means sets of cores can be dried and later transported to the closing bay ready for putting into the mould.

Core Barrows

Where large quantities of light cores are moved about in the foundry suitably designed barrows become invaluable. One or two firms, particularly in

America, have developed elaborate two-wheeled vehicles with special springs and pneumatic tyres, and also less pretentious single-wheel types. In the jobbing type of foundry two-wheeled trucks are likely to find a rather limited range of movement owing to lack of floor space.

The simple single-wheel type having an inflated tyre, as shown in Fig. 16, which depicts a type made

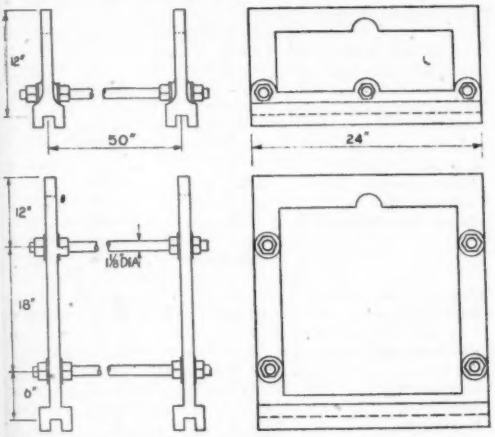

FIG. 15.—SKETCHES GIVING DIMENSIONS OF THE CORE RACKS SUITABLE FOR BUILDING ONE UPON THE OTHER.

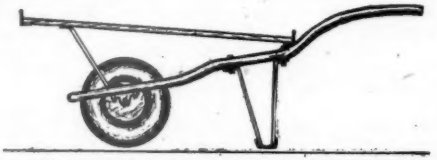

FIG. 16.—SIMPLE TYPE OF PNEUMATIC WHEEL BARROW FOR TRANSPORTING SMALL CORES.

by a well-known firm in this country in which the tubular barrow is fitted with a flat wooden tray, 48 in. by 24 in. This barrow can be easily handled and negotiated round and between boxes where the floor space is considerably congested.

Moisture Absorption Test for Oil Sand

Another test which can usefully be applied to oil sand is one intended to measure the degree of sensitivity to moisture absorption or, as foundrymen say, the tendency to "draw dampness" in a green-sand mould. Some core oils and constituents of core oil have this property to a marked degree, and it can be very troublesome, especially when cores are a long time in a mould before casting.

The method of measurement is simple, consisting of baking a series of test-pieces under identical conditions and exposing part of their number to a humid atmosphere. The remaining test-pieces of the series are tested after baking in the usual way.

This test was put before the Committees in this country in 1934 without as yet coming up for consideration, and it is interesting to note that Dietert's book, "Modern Core Practice and Theories," contains an outline of a similar method. Dietert recommends a specially constructed metal box, lined and having 1 in. of water in the bottom, kept at between 70 and 80 deg. F., and the test-pieces (transverse or tensile) kept in it for 12 hrs.

The author's method uses a B.C.I.R.A. test-piece on standard mixtures for comparing the moisture absorption of different core oils kept for 24 hrs. in a humidor, which was an ordinary glass desiccator in which the drying reagent was replaced by water. The loss of compression strength on exposure to this treatment as compared with unexposed baked test-piece is the measure of moisture absorption, and this is useful in deciding between sources of core oil supply. It may be of interest to quote figures obtained at that time:—The decrease in compression strength was 12 per cent. with core oil A, 15 per cent. with core oil B, and 50 per cent. with core oil C, thus indicating the superiority of core oil A over core oil C.

(To be continued.)

SCOTTISH STEEL DRESSERS' ASSOCIATION

A claim by steel dressers employed by the Steel Company of Scotland, Limited, has resulted in an award by the National Arbitration Tribunal that the firm shall pay a special allowance of ½d. an hour in respect of the time during which steel dressers are employed on any one or more of the following operations:—Dressing of roll wabblers to templates, cutting clearances for planing and slotting, roughing out ends of square-ended keyways, cutting off centres of pintles, bolts, etc.; forming flat for starting drill, chipping the machined face of a scarph to fit it to the requirements of the marker-off, and clearing out the unmachined material at the corner of a locked scarph.

The award is on the footing that, as was intimated by the firm at the hearing would be the case, the special payment made by the firm in respect of the heavy character of the work carried out at the foundry will be continued. The award has effect as from the beginning of the first full pay period following December 21.

Scientific Films.—Readers whose duties embraces the handling or making of scientific films will be interested to learn that a technical association—The Scientific Film Association—has been established Details of its activities can be had by writing to the secretary, Mr. M. Michaelis, B.Sc., 51, Fitzjohn's Avenue, London, N.W.3.

RECORD BLAST FURNACE CAMPAIGN

On January 9 last No. IV blast furnace of Hoesch A.G., Dortmund, was voluntarily blown out, having been in blast continuously for 14 years, states H. SCHNETTLER in "Stahl und Eisen" of June 11 last. The lines and dimensions of the furnace are shown in Fig. 1; it has 10 tuyeres, and blast is introduced from two sides (doppelzeitige Windzuführung). It was relined and reconditioned in 1926, the hearth bottom, well and bosh being lined with carbon blocks, and the shaft with fireclay bricks. The cast-steel casing round the hearth and well was 100 mm. thick and up to the slaghole 150 mm. thick; the bosh casing consisted of riveted steel plates 40 mm. thick, terminating at the main stack base. The stack itself was bound by flat steel hoops anchored to eight cast steel pillars reaching nearly to the throat. Between the hoops were 22 series of open cooling boxes of hematite mounted close to each other.

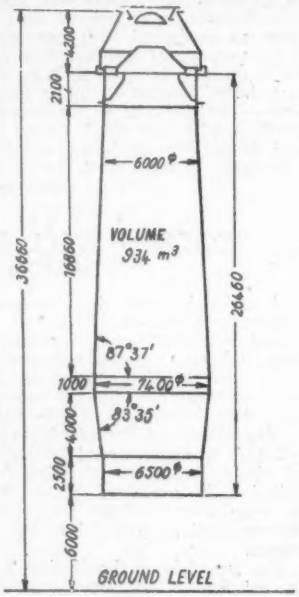

FIG. 1.

The diameter of the throat was 6 m., a record size in Germany at the time the furnace was put in blast (1928). Together with a bilateral blast, this large throat proved very satisfactory in practice, especially after the gap between the furnace wall and the bell had been increased in width from 600 to 1,000 mm. Compared with the other furnaces of the same size with a 5.2 m. throat, but working under comparable conditions in other respects, No. IV furnace as a result showed a reduction of blast pressure of 0.2 atmos., and also gave a more uniform run. No difficulty was encountered in using blast temperatures up to 900 deg. with this furnace, nor with a charge containing a high proportion of sinter or lean domestic ores, the proportion of dust produced being quite small. Contrary to experience on other furnaces, coke consumption did not increase towards the end of the campaign. The following table gives further data for 1933:—

	October 31, 1933.	October 1 to 31 1933.
Maximum daily output of iron	1,412 tons	—
Total tapped in 24 hours	1,471 ,,	—
Maximum monthly output	—	35,800 tons.
Average output per calendar day	—	1,155 ,,
Dry-coke throughput	1,156 ,,	32,858 ,,
Burden throughput—		
Ore and slags	2,638 ,,	72,187 ,,
Limestone	240 ,,	6,396 ,,
Skulls and turnings	26 ,,	744 ,,
	2,904 tons	79,327 tons
Composition of burden—		
Kiruna-D ore	31.8 per cent.	33.8 per cent.
Gellivare lump ore	9.1 ,,	9.3 ,,
Blötberg magnetite	10.9 ,,	10.7 ,,
Wabana	18.2 ,,	19.5 ,,
Lime-minette	7.3 ,,	8.2 ,,
Sinter	—	0.5 ,,
Roast spar	6.8 ,,	4.7 ,,
O.H. slag	6.8 ,,	9.1 ,,
Other Mn slag (4 per cent. Mn)	—	0.7 ,,
Prepared furnace and other slag	8.3 ,,	3.1 ,,
Phosphate	0.8 ,,	0.4 ,,
	100.0 per cent.	100.0 per cent.
Proportion of Swedish ore	51.8 ,,	53.8 ,,
Limestone	9.1 ,,	8.9 ,,
Scrap	1.0 ,,	1.0 ,,
Ore yield	53.0 ,,	49.1 ,,
Burden yield	48.6 ,,	45.1 ,,
Dry coke consumption per ton of pig iron	819 kg.	918 kg.
Blast temperature up to	900 deg.	900 deg.
Number of charges	74	2,110.
Average weight of charge	40 tons	37.6 tons.
Time through furnace	5.8 hours	6.4 hours.
Dust make	200 tons	5,950 tons.
Dust make to burden (per cent.)	6.8	7.9.

The furnace was in blast from February 23, 1928, to January 9 last, *i.e.*, a period of 13 years 10 months and 14 days, during which it produced 3,379,888 metric tons of basic iron. Of this total, 153,000 tons were with an acid slag; produced from

(*Continued on page* 39.)

THE USE OF BASIC-LINED LADLES IN THE DESULPHURISATION OF CAST IRON BY SODIUM CARBONATE

(*Concluded from page* 30.)

Conclusions

It has been shown that the use of basic-lined ladles for carrying out the sodium-carbonate process for desulphurising cast iron results in an appreciably greater degree of desulphurisation than is obtained under otherwise similar conditions in siliceous refractory linings. The improvement is most marked in the treatment of cast iron having initially a sulphur content less than 0.04 per cent. Such iron is sometimes difficult to desulphurise to an appreciable extent in siliceous-lined ladles, but in basic linings it has, in some cases, been possible to reduce the sulphur content to a figure below 0.01 per cent.

Suitable basic lining materials are magnesite, dolomite and stabilised dolomite. The first of these being in short supply, attention was directed mainly to the other two. The best results were obtained in linings of tar-bonded dolomite. Stabilised dolomite, containing about 15 per cent. of silica, is not quite so good, but it gives results superior to those obtainable in firebrick, loam or other acid linings, and it has the advantage over unstabilised dolomite that it can be kept in stock without deterioration by users who have no proper facilities for mixing tar and dolomite and require only small quantities of lining material at a time.

The technique of preparing monolithic basic linings appears to be fairly straightforward. There is scope for further investigation on the subject of basic-brick linings. The question of spalling appears to be less serious in the presence of sodium carbonate slag than the results of the standard spalling test would suggest. Methods of patching linings after a period of use are not so successful as could be desired, and it is felt that this matter would repay further investigation.

The author wishes to acknowledge the help received from a number of individuals and firms who have assisted this investigation by supplying metal and refractory samples and by carrying out full-scale trials. In particular, he would like to mention Mr. E. Shaw, of the Refractory Brick Company of England, Limited, and the late Mr. J. Deschamps, and Mr. Derek Wells, K. & L. Steelfounders & Engineers, Limited, without whose co-operation very little could have been accomplished.

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[3] T. Swinden and J. H. Chesters: "Journal of the Iron and Steel Institute," 1941, No. II., pp. 108 P-109 P.
[4] W. Oelsen: "Stahl und Eisen," 1938, vol. 58, Nov. 3, pp. 1212-1217.
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PUBLICATION RECEIVED

The Spectrochemical and Polarographic Analysis of Aluminium and Its Alloys. Published by the British Aluminium Company, Limited, from their temporary address: Salisbury House, London Wall, London, E.C.2.

This publication, written in plain language and clearly illustrated, wisely presumes that the reader has only a nodding acquaintance with its subject matter. Essentially practical in outlook, all such processes as the casting of the electrode pencils, the treatment of electrode tips and technique for the photography, are given in the fullest detail. There are no less than fifteen pages devoted to systems of plate calibration, which like all other processes involving comparison with standards, admits of a choice of method, and four are included. The evaluation of results is not too easy, and apparently calculators have been devised to ensure speed of reporting. Two main methods, the graphical and the fan scale calculators, are described in some detail. After summarising the methods suggested earlier, the first section of the book closes with recommended methods for all the more popular aluminium alloys.

Part II covers the not so well known technique of polarographic analysis. Because it is simple in principle, elaborate apparatus is not essential to obtain good results. The process is detailed for the estimation of copper, antimony, lead, tin, nickel and zinc in aluminium alloys both as to principle and detail. The reviewer attaches much importance to this publication, and regards it as a reliable textbook worthy of a prominent place in the library of every laboratory servicing the metallurgical industries.

RECORD BLAST FURNACE CAMPAIGN

(*Concluded from page* 38.)

lean domestic ores; the total throughput of dry coke was 3,299,934 tons, and the total burden carried 7,540,211 tons.

Corrosion of the structural work on the furnace made it necessary to interrupt smelting for 42 days from August 8 to September 19, 1938, during which the supporting members of the furnace were reconditioned, as well as the bosh. The first failure of the stack, of which 11 others also occurred during the whole campaign, took place on March 2, 1938, after about 2,600,000 tons of iron had been made. The perforation of the stack was bricked up, the brickwork being gradually extended round the whole stack down to the taphole. The danger of further perforations made the running of the furnace very uncertain towards the end of the campaign, which would not have extended to over 13 years if sufficient blast furnace capacity had been available.

NEWS IN BRIEF

THE ASSOCIATION OF SUPERVISORY STAFF and Engineering Technicians has signed a recognition agreement with the Engineering and Allied Employers' Federation.

MR. BENJAMIN BEAUTYMAN, a brass finisher with the North-Eastern Marine Engineering Company, Limited, Wallsend, has retired at the age of 71, after 57 years' service with the firm.

OBLIGATION to collect all ferrous scrap, including tins, has not been withdrawn from local authorities with mechanical baling or flattening machines, the Ministry of Supply points out.

THE BUSINESS of Mr. Harry Summersgill, ironfounder, Stanacre Foundry, Wapping Road, Bradford, has been taken over by Mr. Edwin Fawcett, of 69, Allerton Road, Bradford, as and from January 1, 1944.

JANUARY 15 is the last day for receiving proofs in connection with a dividend to be paid by the Strand Engineering Works, Limited, 104, Beverley Road, Hull. Mr. J. E. D. Stickney, 1, Parliament Street, Hull, is the liquidator.

BRITISH PIGIRONS, LIMITED, Little Court, Pyrford, Woking, have a few copies of their monthly tear-off calendar, which they will be pleased to send to foundrymen on early application. To comply with the current Paper Control Order, a 2d. stamp should be sent.

THE INTERNATIONAL MEEHANITE METAL COMPANY, LIMITED, have formed a new publicity and development department, and have appointed Mr. W. Findlay Seivewright, late Meehanite sales manager of Cameron & Robertson, Limited, Kirkintilloch, as manager.

THE ASTON CONSTRUCTION COMPANY, LIMITED, states that in the report and accounts for the year to September 30, 1943, recently issued, an error occurred in describing the payment of preference dividend as being for the six years to September 30, 1942, instead for the four years to that date.

THE RENOLD & COVENTRY CHAIN COMPANY, LIMITED, have brought into operation a pension scheme for weekly rated employees. The scheme is based on a qualifying period of service and age, pensions being made available for men at 65 and women at 60. The company already have a pension scheme for their monthly rated employees.

THE COMPANIES REGISTRATION OFFICE gives notice that the names of the undermentioned companies have been struck off the register, and such companies are dissolved:—Cargo Engineering Company, Limited; Consolidated Steel Company, Limited; Electro-Metallurgical Ore Reduction, Limited; Gearless Stokers (London), Limited.

NEARLY ALL the universities of England, Scotland and Wales were represented at the ninth Universities' Industrial Conference which opened in Sheffield on January 3 and continued for four days. The subject for discussion was "Industry To-day and To-morrow." Mr. Clifton Robbins (acting London Director of the International Labour Office) presided.

THE ESTABLISHMENT of a permanent council representing employers, workers, local authorities, and members of Parliament to examine the problem of attracting new industry to the North-East of England, to prevent unemployment and distress in the area, was urged by Mr. C. U. Peat, M.P. for Darlington, and Joint Parliamentary Secretary to the Ministry of Supply, when addressing a meeting at Middlesbrough.

J. BROCKHOUSE & COMPANY, LIMITED, West Bromwich, acquired three additional subsidiary companies during 1943—Ernest Lake, Limited, of Bishop's Stortford, who are proprietors of Harvey Frost, Limited, manufacturers of garage equipment, jacks, and vulcanising equipment; Meldrums, Limited, of Timperley, Manchester, who are principally known for their stokers, forced draft furnaces, and refuse destructors; and John Brooks (Lye), Limited, manufacturers of cast steel anvils and vices.

REPRESENTATIVES of the Iron and Steel Trades' Confederation and the National Union of Blastfurnacemen held a conference in London last week, and are to meet again in a few weeks. The conference was of the opinion that some form of public corporation should be set up to control the iron and steel industry after the war. Other questions under discussion were the period of the paid holiday, wage-regulating machinery, hours of employment, and the compensation of workers displaced owing to concentration or the installation of new plant.

OBITUARY

MR. FRANCIS LOMAX GIBBS, chairman of Minerals Separation, Limited, died at his home in London at the age of 74.

MR. ERNEST GEORGE BROWN, late works manager of the Hoffmann Manufacturing Company, Limited, died at Little Baddow, Chelmsford, on December 30. He was 65 years of age.

THE DEATH OCCURRED last Friday of Mrs. Herbert Hoover, wife of the former president of the United States. In 1912 she published, jointly with her husband, who is a mining engineer, a translation from the Latin of "De Re Metallica," by Georgius Agricola.

CONTRACT OPEN

Any date given is the latest on which tenders will be accepted. The address is that from which tender forms may be obtained.

London, S.W., January 27—Sewer castings, tools, iron, steel, etc., for periods of six and 12 months from March 31, for the Lambeth Borough Council. Mr. G. H. Buckett, Town Hall, Brixton Hill, S.W.2.

Save Fuel
in your CUPOLAS
by using
STANTON
SAND-LESS
Machine Cast
PIG IRON
THE STANTON IRONWORKS COMPANY
LIMITED
NEAR NOTTINGHAM

COMPANY RESULTS

(Figures for previous year in brackets)

Sulphide Corporation—Dividend of 5% on the preference shares.

Beralt Tin & Wolfram—Interim dividend of 5% (same) on account of the year ending March 31, 1944.

Turner & Newall—Net profit for the year to September 30 last, £553,292 (£530,840); preference dividend, £55,604 net (£52,655); ordinary interim dividend of 3½% (same), £110,001 (£104,147); final dividend of 8½% (same), £256,670 (£250,787); welfare trust, £10,000 (same); general reserve, £100,000 (same); forward, £99,457 (£78,440).

Brett's Stamping—Net profit for year to July 17 last, after depreciation, taxation, A.R.P., war damage insurance, etc., £15,297 (£15,360); preference dividend, £600 (same); interim ordinary dividend of 10%, £3,000 (same); final dividend of 15%, £4,500 (same); to special writing-off, plant and machinery, £10,000 (nil); forward, £11,987 (£14,790).

George Turton Platts—Gross earnings in the year to July 31 last, £318,473 (£259,204); taxation, £282,000 (£228,250); net profit, £33,856 (£27,867); preference dividend, £1,936 (same); interim dividend of 7½% on the ordinary shares, £5,121 (same); to reserve for special depreciation, £6,621 (£8,379); to contingencies, £4,000 (nil); final ordinary dividend of 10%, £6,828 (same); bonus of 7½%, £5,121 (same); forward, £25,320 (£21,091).

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Aluminium Aero & Marine Tanks—£1,000. H. D. Taylor, 2, Howard Road, Birmingham, 27, subscriber.

A. Capp & Son, Station Wharf, Erith—Engineers. £5,000. A. and D. Capp.

D. & A. Engineering Company, 47, Locarno Road, Copnor, Portsmouth—£300. J. W. R. and R. B. Dunn, and R. C. Appleby.

Arenco Engineering Company, 5, Quality Court, Chancery Lane, London, W.C.2—£500. H. S. L. Fargher and G. F. Boyce.

Steels Engineering Products, Crown Works, Pallion, Sunderland—£100. J. and J. E. Steel, W. S. Martin, A. Hallsworth, and J. B. Curry.

Vitrosteel Fabrications & Designs, Deacon House, 23, Henry Street, Keighley—Designers and manufacturers of enamelwork, enamelware, metal products, etc. £1,000. J. E. Hill and T. J. L. Slingsby.

Electronic Controls, 17, Victoria Street, London, S.W.1—Designers, manufacturers and exploiters of electronic apparatus for the control of engineering equipment, etc. £100. D. F. Campbell, W. S. Gifford, and G. E. Taylor.

PERSONAL

MR. H. C. F. MOCKRIDGE, of Toronto, has been elected a director of the International Nickel Company of Canada, Limited, in succession to the late Mr. Britton Osler.

MR. E. HUGH ARMITAGE has been appointed a director of Murex, Limited. He is chairman of the Hoffmann Manufacturing Company, Limited, and managing director of Brown Bayley's Steel Works, Limited.

MR. J. E. OWSTON, works manager at the Darlington Rolling Mills for the past 13 years, has been appointed engineer consultant with John Brown & Company, Limited, Sheffield. Mr. Owston went to Darlington in 1928.

MR. J. W. DICK, of Consett, who has had 29 years' service with the Consett Iron Company, Limited, latterly in the traffic department, has been appointed traffic manager with the South Durham Steel & Iron Company, Limited.

MR. F. S. WHALLEY (vice-chairman and managing director of the Vulcan Foundry, Limited, and a director of the North British Locomotive Company, Limited), Mr. W. D. Lorimer (a director of North British Locomotive Company), and Major-General A. E. Davidson (a director of Vulcan Foundry), have joined the board of Robert Stephenson & Hawthorns, Limited, locomotive builders.

Wills

HEAPS, H. R., of Headingley, lead manufacturer ...	£21,462
PEARSON, SIR LOUIS, of Nottingham, head of the Beeston Boiler Company, Limited	£459,954
JOHNSON, A. W., chairman of E. S. Johnson & Company, Limited, Newcastle-upon-Tyne, iron and steel stockholders	£10,956
BACHE, E. W., of Great Barr, chairman and managing director of George Salter & Company, Limited, ironfounders, West Bromwich...	£41,596

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"TERRUX"—Fluxes. METROPOLITAN-VICKERS ELECTRICAL COMPANY, LIMITED, 1, Kingsway, London, W.C.2.

"WHISCO"—Steel bars. WHITEHEAD IRON & STEEL COMPANY, LIMITED, Courtybella Works, Cardiff Road, Newport, Mon.

"METPLASTIC"—Metallic wool. JOHN YUILLE (METAL WOOLS), LIMITED, 142, St. Vincent Street, Glasgow, C.2.

"METVIC"—Scientific and electrical instruments and apparatus. METROPOLITAN-VICKERS ELECTRICAL COMPANY, LIMITED, 1, Kingsway, London, W.C.2.

MR. WILLIAM A. BREWIS, of Darlington, who died on Saturday last, had been 55 years in the service of the Cleveland Bridge & Engineering Company, Limited, and had been secretary of the company since 1938.

Don't HOLD it BACK!

SHORTAGE of rubber means using our road vehicles with the greatest economy. And that means getting every hour of running time we can from the vehicles in use. While you hold up a lorry it can't move goods and *that is what it is for.*

Of course lorries must stop for loading and unloading. But can you cut down that lost journey time? Say to yourself that *every* vehicle, no matter where it goes, is serving the war effort, serving the fighting men. All journeys, now, lead to the battlefront.

You know your own problems best. Tackle them in your own way. But tackle them now. Plan, encourage ideas, improvise if needs be. Here's a starting-off agenda:

1. CLEAR LABELS AND DOCUMENTS
2. LABOUR SAVING DEVICES.
3. WORK IN BLACK-OUT AND AT WEEK-ENDS.
4. OPINIONS OF "MEN WHO DO THE WORK"

QUICKER TURNROUND THAN EVER BEFORE

Issued by the Ministry of War Transport

2

Raw Material Markets

IRON AND STEEL

The position has changed very little recently. Many of the ironfoundries are much less busy than they were twelve months ago. On the other hand, a lot of the general engineering and speciality foundries keep very active and have plenty of work in hand and in front of them. Government departments still require large quantities of castings, both iron and steel, in connection with armaments, munitions, machine tools and the like. Nevertheless, some engineering and jobbing foundries are on the look-out for new business. At present, there is no great difficulty in the matter of raw materials. Ample supplies of medium- and low-phosphorus and refined pig-iron are available, and for those foundries that use high-phosphorus iron there is no shortage. The steel scrap position, as it applies to foundries, is not too easy, and the Control is limiting supplies. The hematite pig-iron position is unaltered. A strict watch is kept by the Control on supplies, and only in cases of absolute need is this type of iron released.

Prospects do not look too bright for the light-castings trade. Most of the foundries are short of work, and the future is very uncertain, as it is not possible to see at this juncture any substantial increases in the allocations of domestic goods, a revival of the building trade, or an improvement in exports, all of which seriously concern the light-castings trade.

Coke and limestone supplies are regular and sufficient to meet the needs of the foundries, and no great difficulty is being met in getting ganister and firebricks within reasonable periods.

Reduction of steel-ingot production over the holidays was very slight, and all the big melting plants are again working to capacity. The upward trend of the demand for special steels for the aircraft industry is still maintained, and rolling mills also call for heavy tonnages of basic steel. Re-rollers are getting good deliveries of prime billets, sheet bars, etc., and are also using considerable quantities of defectives, crops, etc. Deliveries of semis from home sources have, in fact, been so satisfactory of late that there has been little need to encroach upon the stocks of imported material. Output of the re-rolling mills in the form of light angles, rounds, squares, flats and strip is already mortgaged for the next three months. Sheet makers are overwhelmed with orders. A good deal of their output is required for the shipbuilding yards, while War Office requirements also figure prominently in their specifications.

The expansion in the production of steel plates which has recently been effected has had no visible effect in reducing the call for supplies. Forward bookings extend to the end of the second period, and this, of course, is of assistance in the arrangement of rolling programmes. For heavy sections, there is a strictly limited demand, but big outputs of light and medium sizes are still needed.

NON-FERROUS METALS

There have been no fresh price developments since the unexpected advance in tin as from January 1. The alteration is bound to make some difference to the price of gunmetal, but there is no indication that a change is contemplated in copper, lead, zinc or any of the other metals coming within the purview of the Non-ferrous Metals Control. As the Control is the sole arbiter in these matters, there can, indeed, be no prior indication of a change. Under the present system, coming price changes are not events that cast their shadows before, and, as in the case of the recent increase in tin, any alteration in the basis prices of the other metals is likely to be in force as soon as it is announced.

The price of tin had remained unchanged since December, 1941, when an advance of about £17 followed the declaration of war by Japan and trading on the London Metal Exchange was suspended. Lead, zinc and copper have been at their current levels since December, 1939. Costs of providing the metal have presumably varied during the intervening period, but selling prices have been maintained at the fixed levels. There is no reason to believe that any general change is contemplated, though it is to be assumed that some at least of the factors that influenced the advance in tin apply to other metals as well.

The supply position meantime shows little change. It is gratifying that in the fifth year of war copper should be available on the present adequate scale, for though consumption is probably below its peak, the war industries must still be consuming a very big tonnage. There is no reason to suppose that needs will not continue to be adequately covered. Zinc also is in plentiful supply to cover war requirements, and a further relaxation of the restrictions on galvanising would not be surprising. It has to be kept in mind in connection with this metal, however, that it makes substantial demands on shipping space, and savings in consumption are all to the good. The same consideration applies to lead, which appears to be in rather tighter supply, though it is unlikely that there has been any expansion of the demand. Tin continues to be available to meet really essential needs, but the Control maintains a careful watch over distribution, in order to conserve supplies. Production of aluminium has been greatly increased since the war began, but every ton finds a ready outlet.

THE BOARD OF INLAND REVENUE have agreed to the adoption by employers of a modification in the procedure for deducting income-tax under "pay as you earn." This modification was suggested by Mr. J. Clayton, a member of the committee of the Confederation, and was submitted by the Confederation to the Board with the object of reducing the work to be done by employers immediately preceding pay day. If an employer wishes to adopt the modified procedure in place of the normal procedure, he must obtain the authority of the local inspector of taxes.